

TECHNICAL MANUAL

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL**

**(INCLUDING REPAIR PARTS AND
SPECIAL TOOLS LIST)**

**CENTRIFUGE, LABORATORY
MODEL SERO-FUGE II**

6640-01-143-2055

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1995



SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

Do not try to pull or grab the individual.

If possible, turn off the electrical power.

If you cannot turn off the electrical power, pull, push, or lift the person to safety using a dry wooden pole or a dry rope, or some other insulating material.

Send for help as soon as possible.

After the injured person is free of contact with the source of electrical shock, move the person a short distance away and immediately start artificial resuscitation.

Throughout this manual are WARNINGS, CAUTIONS, and NOTES. Please take time to read these. They are there to protect you and the equipment.

WARNING

Procedures which must be observed to avoid personal injury, and even loss of life.

CAUTION

Procedures which must be observed to avoid damage to equipment, destruction of equipment, or long-term health hazards.

NOTE

Essential information that should be remembered.

ELECTRICAL AND ELECTRONIC HAZARDS

- » Severe injury or death can result when any part of your body comes in contact with live electrical circuits. Medical Equipment Repairers must be especially alert to the dangers of exposed circuits, terminals, power panels, and the like.
- » The electrical parameter that injures and kills is CURRENT; the force that caused current to flow is called VOLTAGE. Voltage ratings are normally assigned to live electrical circuits, power supplies, and transmission lines. You should consider all voltages of 30 or more to be hazardous.
- » The physiological effect of current flowing through the human body is related to the following factors:
 - The path of the current through the body.
 - The magnitude of the current.
 - The duration of the voltage shock or discharge that causes current flow.
 - The frequency of the voltage if alternating current.
 - The susceptibility of damage to your heart from the current and from repeated shocks.
- » Alternating current tends to concentrate near the body's surface because of the phenomenon of "skin effect." The higher the frequency of the alternating current voltage source, the more likely the current will tend to flow in or near the skin and away from internal body organs.
- » The effect of current becomes more severe with the length of time that it flows through the body; a prolonged current flow can cause severe internal burns, collapse, unconsciousness, or death.

TECHNICAL MANUAL

NO. 8-6640-001-24&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC 12 June 1995

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)
CENTRIFUGE, LABORATORY
MODEL SERO-FUGE II
6640-01-143-2055**

You can help improve this manual. If you find any mistakes or if you know a way to improve procedures, please let us know. Mail your memorandum, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 (Recommended Changes to Equipment Technical Publications) located in the back of this manual to: Commander, U.S. Army Medical Materiel Agency, ATTN: MCMR-MMM, Frederick, MD 21702-5001. A reply will be furnished directly to you.

Approved for public release; distribution is unlimited.

TABLE OF CONTENTS

	<i>Page</i>
HOW TO USE THIS MANUAL	iv
CHAPTER 1. INTRODUCTION	
Section I. General Information	1-1
II. Equipment Description and Data	1-2
III. Principles of Operation	1-6
CHAPTER 2. OPERATING INFORMATION AND INSTRUCTIONS	
Section I. Preparation for Operation	2-1
II. Operating Information	2-1
III. Operating Instructions	2-2
IV. Operation of Auxiliary Equipment	2-3
V. Cleaning and Disinfecting Procedures	2-3
VI. Operation under Unusual Conditions	2-4

CHAPTER	3.	UNIT LEVEL MAINTENANCE	
Section	I.	General Information	3-1
	II.	Service Upon Receipt of Equipment	3-2
	III.	Lubrication Instructions	3-2
	IV.	Preventive Maintenance Checks and Services	3-2
	V.	Operational Testing	3-5
	VI.	Troubleshooting	3-7
	VII.	Circuit Descriptions	3-10
	VIII.	Repair Procedures	3-11
	IX.	Voltage Conversion Instructions	3-22
	X.	Storing and Shipping Procedures	3-23
CHAPTER	4.	DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE	
Section	I.	General Information	4-1
	II.	Maintenance Procedures	4-1
APPENDIX	A.	REFERENCES	A-1
	B.	MAINTENANCE ALLOCATION CHART	B-1
	C.	COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST	C-1
	D.	EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST	D-1
	E.	REPAIR PARTS AND SPECIAL TOOLS LISTS	E-1
GLOSSARY			GLOSSARY-1
INDEX			INDEX-1

LIST OF ILLUSTRATIONS

<i>Figure No.</i>	<i>Title</i>	<i>Page</i>
1-1	Centrifuge	1-1
1-2	Step-down transformer	1-3
1-3	Test tubes	1-3
1-4	Manufacturer data plate	1-4
1-5	Nameplate	1-4
1-6	Warning data plate	1-4
1-7	Information decal	1-5
1-8	Balanced load caution decal	1-5
1-9	Spinning rotor caution decal	1-5
2-1	Controls	2-1
3-1	Nameplate assembly	3-5
3-2	Cover safety switch	3-6
3-3	Wiring diagram	3-10

<i>Figure No.</i>	<i>Title</i>	<i>Page</i>
3-4	Governor brushes	3-11
3-5	Governor brush assembly clearance	3-12
3-6	Governor	3-12
3-7	Governor removal	3-13
3-8	Governor brush assembly clearance	3-13
3-9	Motor	3-14
3-10	Governor brush assembly clearance	3-16
3-11	Electrical power cable assembly	3-16
3-12	Speed switch	3-18
3-13	Brake switch	3-19
3-14	Timer	3-20
3-15	Cover safety switch	3-21
3-16	Electrical connections	3-22
E-1	Centrifuge components	E-2

LIST OF TABLES

<i>Table No.</i>	<i>Title</i>	<i>Page</i>
1-1	Nomenclature cross-reference list	1-2
1-2	Miscellaneous characteristics	1-3
1-3	Specifications	1-4
3-1	Operator preventive maintenance checks and services	3-3
3-2	Repairer preventive maintenance checks and services	3-4
3-3	Operator/user troubleshooting	3-8
3-4	Medical Equipment Repairer troubleshooting	3-8

HOW TO USE THIS MANUAL

This manual provides all the information needed to understand the capabilities, functions, and characteristics of this equipment. It describes how to set up, operate, test, and repair the equipment. You must familiarize yourself with the entire manual before operating or beginning a maintenance task.

The manual is arranged by chapters, sections, and paragraphs followed by appendixes, a glossary, an index, and DA Forms 2028-2. Use the table of contents to help locate the chapter or section for the general subject area needed. The index will help locate more specific subjects.

Multiple figures and tables are provided for your ease in using this manual. Words that are both capitalized and in quotation marks are names of components or words that you will actually see on the equipment.

Chapter 3 provides a systematic method of inspecting and servicing the equipment. In this way, small defects can be detected early before they become a major problem causing the equipment to fail. Make a habit of doing the checks and services in the same order each time and anything wrong will be detected quickly.

Only perform maintenance functions specified in the maintenance allocation chart for your level of maintenance. Maintenance functions specified for higher levels of maintenance frequently require additional training; test, measurement, and diagnostic equipment; or tools.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Overview.

This manual describes the centrifuge (fig 1-1); provides equipment technical data; and provides operational and maintenance functions, services, and actions. Additional information follows:

a. Type of manual. Unit, direct support (DS), and general support (GS) maintenance (including repair parts and special tools list).

b. Model number and equipment name. Model number SERO-FUGE II, Centrifuge, Laboratory.

c. Purpose of equipment.

(1) To provide basic laboratory tests such as blood typing, cell washing, cross-matching, genotyping, Coombs testing, and Anti-Rh titers.

(2) To provide more delicate centrifugations of weak agglutination reactions.

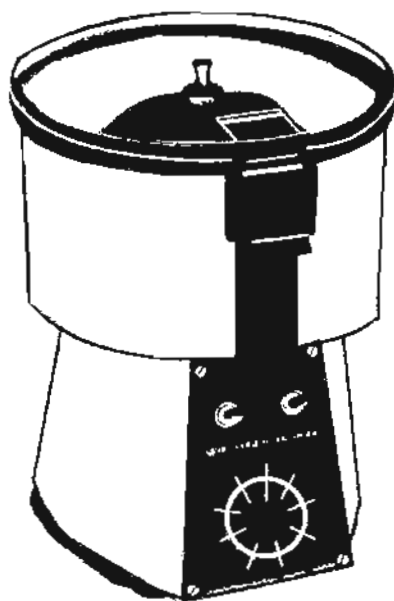


Figure 1-1. Centrifuge.

1-2. Explanation of abbreviations and terms.

Special or unique abbreviations, acronyms, and terms used in this manual are explained in the glossary.

1-3. Maintenance forms, records, and reports.

TB 38-750-2 prescribes forms, records, reports, and procedures.

1-4. Destruction of Army materiel to prevent enemy use.

AR 40-61 contains instructions for destruction and disposal of Army medical materiel. Also, the SB 8-75 series provides periodic information and/or instructions on the destruction of medical materiel.

1-5. Administrative storage.

a. Place the centrifuge in administrative storage for only short periods of time when a shortage of maintenance effort exists. This equipment should be in mission readiness condition within 24 hours or within the time factors determined by the directing authority. During the storage period, keep appropriate maintenance records.

b. Perform preventive maintenance checks and services (PMCS) listed in tables 3-1 and 3-2 before placing Army equipment in administrative storage. When equipment is removed from storage, perform PMCS to ensure its operational readiness.

c. Inside storage is preferred for equipment selected for administrative storage.

1-6. Preparation for storage or shipment.

Procedures to prepare the centrifuge for storing or shipping are listed in chapter 3, section X.

1-7. Quality control (QC).

TB 740-10/DLAM 4155.5/AFR 67-43 contains QC requirements and procedures.

1-8. Nomenclature cross-reference list.

Table 1-1 identifies official versus commonly used nomenclatures.

Table 1-1. Nomenclature cross-reference list.

<i>Common Name</i>	<i>Official Nomenclature</i>
Centrifuge	Centrifuge, laboratory
Spindle	Drive spindle
Speed switch	Switch assembly, Hi-Lo
Governor	Motor governor

1-9. Reporting and processing medical materiel complaints and/or quality improvement reports.

AR 40-61 prescribes procedures for submitting medical materiel complaints and/or quality improvement reports for the centrifuge.

1-10. Warranty information.

A warranty is not applicable.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-11. Equipment characteristics, capabilities, and features.

a. The centrifuge is a compact, two-speed unit designed for use in blood banks and clinical laboratories to perform basic test procedures.

- b. The centrifuge operates from multiple voltages and frequencies.
- c. A stand-alone step-down transformer is provided for operation on 230 volts.
- d. The centrifuge includes a 12-place, plastic rotor assembly.

1-12. Component and accessory descriptions.

a. Components.

(1) *Rotor assembly.* The plastic rotor assembly can accommodate up to 12 10x75 millimeter centrifuge test tubes or any other test tubes less than 12.7 millimeters in diameter and 75 millimeters in length. The rotor assembly is installed without tools by lowering it onto the spindle and turning it clockwise until it locks into place.

(2) *Step-down transformer (fig 1-2).* The stand-alone transformer is used to operate the centrifuge from a 230-volt source of electrical power.

b. Accessories.

(1) An initial manufacturer sample quantity (1 box of 12) of test tubes (fig 1-3) is provided for use.

(2) Optional accessories such as rotor assembly liners and specialized test tubes are not initially provided with the centrifuge.

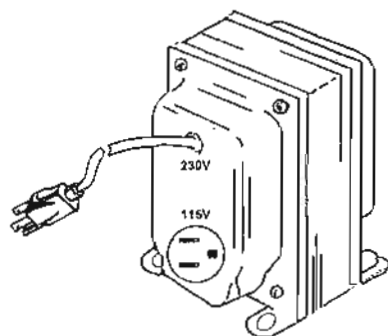


Figure 1-2. Step-down transformer.

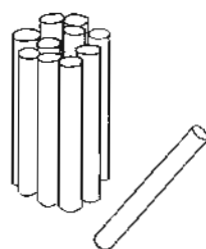


Figure 1-3. Test tubes.

1-13. Tabulated data, decals, and data plates.

The tabulated data provides miscellaneous characteristics, specifications, and other information for the centrifuge.

a. *Miscellaneous characteristics and specifications.* Table 1-2 and table 1-3 provide a broad range of miscellaneous characteristics and specifications to include operating voltages, rotor speeds, rotor capacity, dimensions, and weight.

Table 1-2. Miscellaneous characteristics.

Dimensions	
Height	27.9 cm (11.0 in)
Width	21.6 cm (8.5 in)
Depth	24.1 cm (9.5 in)
Weight	8.6 kg (19.0 lbs)
Rotor test tube capacity	12 test tubes
Rotor test tube size	12.7 mm by 75 mm

Table 1-3. Specifications.

Voltages/frequencies	115 VAC, 50/60 Hz or 230 VAC, 50/60 Hz
Rotor speed/relative centrifugal force	
High (60 Hz)	3300 rpm/1000 g
Low (60 Hz)	2400 rpm/500 g
High (50 Hz)	2833 rpm/740 g
Low (50 Hz)	2000 rpm/278 g
Storage temperature range	-17.78°C (0°F) to 48.9°C (120°F)

b. Identification, instruction, and warning plates, decals, or markings.

(1) The centrifuge manufacturer data plate (located on the bottom of the centrifuge) is depicted in figure 1-4.



Figure 1-4. Manufacturer data plate.

(2) A nameplate (located on the front of the base assembly) containing operating control information is depicted in figure 1-5.

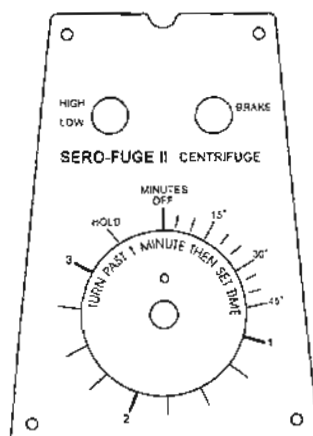


Figure 1-5. Nameplate.

(3) A warning data plate (located on the bottom of the centrifuge) is depicted in figure 1-6.

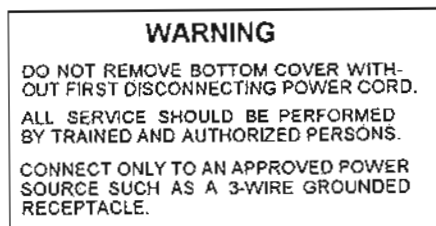


Figure 1-6. Warning data plate.

(4) A decal (located on the bottom of the centrifuge) providing replacement parts information is depicted in figure 1-7.

NOTICE
WHEN ORDERING REPAIR
OR REPLACEMENT PARTS
PLEASE INDICATE CATALOG
NO. AND SERIAL NO. OF UNIT

Figure 1-7. Information decal.

(5) A balanced load caution decal (located on the guard of the centrifuge) providing operational information is depicted in figure 1-8.

CAUTION
Possible Casualty Hazard.
Balance Load Before Operating
Any Centrifuge.

Figure 1-8. Balanced load caution decal.

(6) A caution decal (located on the cover) providing rotor information is depicted in figure 1-9.

CAUTION
DO NOT OPEN UNTIL
ROTOR HAS STOPPED

Figure 1-9. Spinning rotor caution decal.

1-14. Model differences.

Model differences are not applicable since this manual covers a single model.

1-15. Safety, care, and handling.

- a. Observe each WARNING, CAUTION, and NOTE in this manual.
- b. Read the operating instructions in this manual before operating the centrifuge. Refer servicing to qualified Medical Equipment Repairer personnel.
- c. Balance the centrifuge rotor assembly test tube load for vibration free operation and extended centrifuge life.

CAUTION

Do not balance the centrifuge rotor assembly by using weights, mercury, or lead shot in the bottom of test tubes.

- d. Ensure that the centrifuge is operated with the correct voltage.

WARNING

Do not circumvent the cover safety switch and operate the centrifuge.

- e. Monitor the life of the rotor assembly and replace it after 5 years of use.
- f. Do not use the centrifuge in the presence of flammable anesthetics to preclude a possible explosion.

Section III. PRINCIPLES OF OPERATION

1-16. Basic operation.

a. Centrifugation is based on the principle that an object moving in a circular path at a steady angular velocity is subjected to an outward directed force. The magnitude of this force depends upon the angular velocity and the radius of rotation.

b. The basic components of the laboratory centrifuge include an electric motor, a rotor assembly, an electrical timer, an electrical brake, and a cover for safety. Samples to be centrifuged are placed within tubes, cups, or bottles and then placed into the rotor assembly.

c. The centrifuge applies centrifugal force to separate suspended particles from a liquid or to separate liquids of multiple densities. These liquids can be body fluids (blood, serum, or urine), commercial reagents, or mixtures of both with other additives.

CHAPTER 2

OPERATING INFORMATION AND INSTRUCTIONS

Section I. PREPARATION FOR OPERATION

2-1. Scope.

This manual is primarily intended to provide information, instructions, and procedures for the maintenance of the centrifuge. The operating information and instructions, while valid, do not provide sufficient information to perform clinical laboratory tests.

2-2. Assembly.

- a. Remove the centrifuge, components, and accessories from their storage container.
- b. Place the centrifuge on a clean, flat, and sturdy work surface.
- c. Ensure that the rotor assembly is properly locked into place or rotate it on the spindle until it locks into place.
- d. Place the step-down transformer back into the storage container unless voltage conversion is required. If it is required, notify your Medical Equipment Repairer personnel.

Section II. OPERATING INFORMATION

2-3. Controls (fig 2-1).

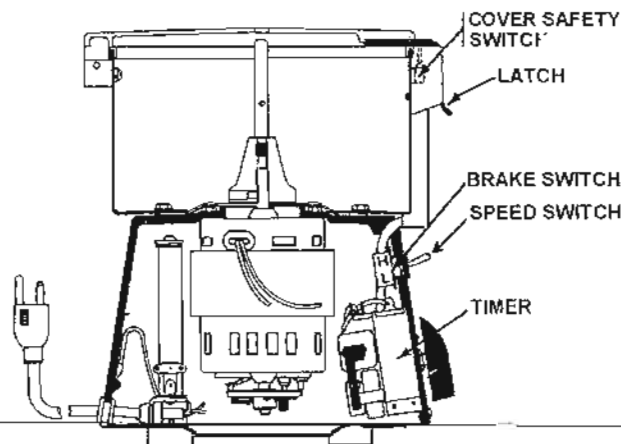


Figure 2-1. Controls.

- a. *Latch and cover safety switch.* The centrifuge cover latch, when closed, depresses the cover safety switch and permits operation of the centrifuge.
- b. *Speed ("HIGH/LOW") switch.* The two-position toggle switch is used to select either the high speed (3400 rpm) or slow speed (2400 rpm) mode of operation.

NOTE

The speeds are lower on 50 Hertz operation.

c. *Brake switch.* The spring-loaded toggle switch is used to shorten the deceleration time of the rotor assembly. The electric brake is activated by depressing the toggle switch downward and holding it down until the rotor assembly stops. Then, immediately release the switch.

d. *Electric timer.* The timer automatically starts and stops centrifugation at intervals of 5 seconds to 3 minutes or continuously. The timer is activated by rotating the pointer knob clockwise from the "OFF" position to the desired centrifugation time. When the pointer returns to the "OFF" position, the centrifuge is deactivated.

Section III. OPERATING INSTRUCTIONS

2-4. Initial start-up procedures.

- a. Move the centrifuge to the appropriate laboratory area and place it on a clean, flat, and sturdy work surface.
- b. Ensure that the electrical timer pointer knob is at its "OFF" position.
- c. Ensure that the rotor assembly is properly locked into place or rotate it on the spindle until it locks into place.
- d. Connect the electrical power cable assembly into a 115-volt electrical receptacle.
- e. Select the high or low rotor speed position by using the speed toggle switch.
- f. Load the rotor assembly with test tubes for centrifugation.
- g. Close and latch the centrifuge cover.
- h. Turn the centrifuge on by rotating the timer pointer knob clockwise past the desired time marker and then counterclockwise to the desired setting.

2-5. Routine start-up procedures.

Daily routine start-up procedures will follow the initial start-up procedures except for differences involving actual clinical tests with varying centrifugation times and rotor assembly speeds.

2-6. Operating procedures.

a. This centrifuge has been designed to facilitate the performance of blood testing procedures involving centrifugation, incubation, and cell washing with a minimum of test tube handling. Many procedures can be performed entirely without removing tubes from the centrifuge rotor assembly, thereby reducing the possibility of errors in transferring tubes. Operating procedures should be accomplished in accordance with your unit's standard operating procedures.

b. The following information is intended to set practical guidelines for some of the most common clinical test procedures.

(1) *Cell washing.* This centrifuge may be conveniently used for many clinical tests that require single or multiple blood cell washings such as the direct or indirect Coombs test, the elution technique of antibody identification, etc. A 1-minute spin in the centrifuge at high speed is generally sufficient to produce a "button" of cells of the required hardness for washing. Since the test tubes are held at an angle of 45 degrees during centrifugation, the cells are quickly deposited at the bottom of the test tubes after sliding down the walls of the angled tubes. Then, after the "button" is formed, the supernatant saline solution can be readily poured off all test tubes simultaneously by removing the rotor assembly from the spindle immediately after it stops spinning and inverting the rotor assembly.

(2) *Agglutination tests.* The centrifugation time and speed for albumin and saline agglutination tests vary significantly as a result of manufacturer serum differences and variations in clinical laboratory personnel preferences in reading test "buttons." Carefully follow your unit's standard operating procedures.

2-7. Shut-down procedures.

Shut-down procedures are as follows:

- a. Turn the timer pointer knob to its "OFF" position.
- b. Ensure that the centrifuge is not operating by glancing through the clear plastic cover.
- c. Open the latch and lift up the cover.
- d. Remove the test tubes.
- e. Refer to this chapter, section V, for cleaning, disinfecting, and sterilizing procedures.

Section IV. OPERATION OF AUXILIARY EQUIPMENT

2-8. Associated support items of equipment.

The centrifuge requires no associated support items of equipment other than an electrical power generator, which is shared with multiple items of laboratory equipment for electrical power.

2-9. Associated material.

Associated material is identified in appendix D and appendix E.

Section V. CLEANING AND DISINFECTING PROCEDURES

2-10. General.

- a. The centrifuge should be clean at all times. Specific cleaning procedures are provided in subsequent paragraphs.
- b. Follow your unit's standard operating procedures for the use of personal protective equipment when cleaning the centrifuge. Personal protective equipment may include goggles, mask, gloves, and gown or other suitable clothing.

2-11. Centrifuge.

- a. *Cleaning.*
 - (1) Disconnect the electrical power cable assembly from the electrical receptacle.
 - (2) Wipe the interior and exterior surfaces of the centrifuge guard, rubber channel, guard seal, and rotor with a soft cloth dampened with warm water.
 - (3) Use a mild detergent occasionally to remove stains.
 - (4) Wipe the cover daily with a soft cloth dampened with a mild detergent.

CAUTION

DO NOT use carbon tetrachloride, gasoline, or acetone to clean the cover. Other chemicals, such as aromatic hydrocarbons (benzene, toluene, and xylene) and strong alkalies (sodium and ammonium hydroxide) may also damage the cover.

- b. *Disinfecting.* Disinfect the centrifuge by wiping it with a liquid disinfectant or lightly spraying it with disinfectant in accordance with your unit's standard operating procedures.

Section VI. OPERATION UNDER UNUSUAL CONDITIONS

2-12. General.

The centrifuge is designed to operate only within a medical treatment facility.

CHAPTER 3

UNIT LEVEL MAINTENANCE

Section I. GENERAL INFORMATION

3-1. Overview.

a. Unit level maintenance. This level of maintenance is the responsibility of and performed by a using unit on its assigned equipment. Responsibilities are stratified as follows:

(1) *Operator maintenance.* This segment of unit level maintenance is performed by operator/user personnel and consists of equipment operational functions; routine services like cleaning, dusting, washing, checking for frayed cables, and stowing items not in use; and checking for loose hardware, replacing operator accessories, and replacing operator repair parts. Replacing operator parts will not require extensive disassembly or reassembly of the end item, critical adjustments after replacement, or the extensive use of tools.

(2) *Specialist maintenance.* This segment of unit level maintenance is performed only by trained Medical Equipment Repairers. The functions and services include—

(a) Scheduling and performing PMCS, electrical safety inspections and tests, and calibration/verification/certification (CVC) services.

(b) Performing unscheduled maintenance functions with emphasis on replacing assemblies, modules, or PCBs, when available.

(c) Operating a repair parts program to include Class VIII repair parts as well as other commodity class repair parts used on medical equipment.

(d) Maintaining a library of technical manuals (TMs), manufacturers' literature, repair parts information, and related materials.

(e) Conducting inspections on new or transferred equipment.

(f) Establishing administrative procedures for the control and administration of maintenance services in accordance with TB 38-750-2.

(g) Notifying support maintenance battalions of requirements and/or evacuating unserviceable equipment, assemblies, or modules.

b. Maintenance functions. Maintenance functions, both preventive and corrective, which are beyond the scope of the operator/user are assigned to unit level Maintenance Equipment Repairer personnel. These personnel will perform the majority of maintenance required for the equipment except some tasks involving the guard or base assembly.

3-2. Tools and test equipment.

Common tools and test equipment required for unit level maintenance of the equipment are listed in appendix B, section III of this manual. Refer to your unit's modified table of organization and equipment (MTOE) for authorized items.

3-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, sections II and III of this manual.

3-4. Expendable supplies.

Expendable and durable supplies and materials required for maintenance of the equipment are listed in appendix D, section II of this manual.

3-5. Repair parts.

Repair parts required for unit level maintenance are listed in appendix E, section II of this manual.

3-6. Special tools.

Special tools required for unit level maintenance of the equipment are listed in appendix E, section III of this manual.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

3-7. Unpacking the centrifuge.

- a. Open the top flaps of the exterior carton.
- b. Remove the operators manuals (2).
- c. Remove the step-down transformer carton and set it aside.

NOTE

The transformer is only required for centrifuge operation on 230 volts.

- d. Remove the inside foam packaging material.
- e. Remove the inner carton containing the centrifuge. Open the carton and remove the centrifuge.
- f. Place the centrifuge on a clean, flat, and sturdy working surface.
- g. Remove the small package containing the test tubes. Set it aside.
- h. Replace the packaging materials and the transformer back into the carton. Set it aside for later use.

Section III. LUBRICATION INSTRUCTIONS

3-8. General.

No lubrication of the centrifuge is required. The bearings are permanently lubricated.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-9. General.

a. The centrifuge must be inspected and serviced systematically to ensure that it is ready for operation at all times. Inspection will allow defects to be discovered and corrected before they result in serious damage or failure.

b. Table 3-1 contains a list of items to be performed by unit level operator/user personnel. This PMCS table is also referred to as "10 PMCS" requirements. Preventive maintenance by operator/user personnel is not limited to performing the checks and services in table 3-1. There are things operator/user personnel should do any time they need to be done, such as checking general cleanliness, observing for improper operational indicators, and maintaining the proper quantities of accessories.

c. Table 3-2 contains a list of items to be performed by unit level Medical Equipment Repairers. This PMCS table is also referred to as "-20 PMCS" requirements.

d. Some items to be inspected will be listed in both table 3-1 and table 3-2 to stress their importance, to provide a quality control check on multiple operator/user personnel, and to identify more comprehensive procedures to be accomplished by unit level Medical Equipment Repairers.

e. The following is a list of both PMCS table column headings with a description of the information found in each column:

(1) *Item No.* This column shows the sequence in which to do the PMCS, and is used to identify the equipment area on the Equipment Inspection and Maintenance Worksheet, DA Form 2404.

(2) *Interval.* This column shows when each PMCS item is to be serviced: **B**-Before Operation, **D**-During Operation, **A**-After Operation, **Q**-Quarterly, and **S**-Semiannually. **B**, **D**, and **A** should be performed with daily use of the equipment.

NOTE

When the centrifuge must be kept in continuous operation, check and service only those items that will not disrupt operation. Perform the complete daily checks and services when the equipment can be shut down.

(3) *Item to be Inspected and Procedure.* This column identifies the general area or specific part to be checked or serviced.

(4) *Equipment is not Ready/Available if:* This column lists conditions that make the equipment unavailable or unusable.

Table 3-1. Operator preventive maintenance checks and services.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
1	X				X	Rotor assembly. <i>a.</i> Ensure that the rotor assembly locks into place on the spindle.	The rotor assembly does not lock into place.
	X				X	<i>b.</i> Check for a buildup of foreign matter, pitting from corrosive chemicals, or cracks.	The rotor assembly could fail during operation.
<p style="text-align: center;">NOTE</p> <p style="text-align: center;">A rotor assembly should be replaced after five years of use.</p>							
2	X				X	<i>c.</i> Verify that the rotor assembly does not vibrate excessively during operation.	The vibration of the spinning rotor assembly causes the centrifuge to move or creates a hazardous situation.
	X				X	Centrifuge. <i>a.</i> Inspect the electrical power cable assembly for cuts, fraying, or other physical damage.	The condition of the cable assembly prevents operation or causes a hazard.

Table 3-1. Operator preventive maintenance checks and services - continued.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
	X				X	b. Verify that the cover latches properly.	The unlatched cover causes a safety hazard.
	X				X	c. Check that the speed switch changes operation from "HIGH" (3400 rpm) to "LOW" (2400 rpm).	Both centrifugation speeds are not available.
	X				X	d. Verify that the timer operates and controls operation of the centrifuge.	The timer prevents timed and continuous ("HOLD") operation.
	X				X	e. Verify that the brake switch decelerates the spinning rotor assembly.	The brake switch is inoperative and prevents test techniques.
	X	X		X		f. Check for noisy operation.	The noisy operation caused by rotor assembly wobble or electrical arcing indicates a hazardous situation or a safety hazard.
	X				X	g. Verify that the centrifuge is inoperative with the cover unlatched.	The centrifuge operates with the cover unlatched.

Table 3-2. Repairer preventive maintenance checks and services.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
1					X	Rotor assembly. a. Ensure that the rotor assembly locks into place on the spindle.	The rotor assembly does not lock into place.
					X	b. Verify that the rotor assembly has no cracks and has less than five operating years.	The rotor could cause hazardous operation.
					X	c. Check for excessive vibrations.	The centrifuge vibrates excessively.
2						Centrifuge.	
					X	a. Inspect the electrical power cable assembly for cuts, deterioration, fraying, or other physical damage.	The condition of the cable assembly prevents operation or causes a hazardous situation.
					X	b. Verify that the cover latches properly and prevents operation if unlatched.	The unlatched cover allows operation.

Table 3-2. Repairer preventive maintenance checks and services - continued.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
					X	c. Verify that the brake switch decelerates the spinning rotor assembly to stop it.	The brake switch is inoperative and prevents proper test procedures.
					X	d. Verify high (3400 rpm) and low (2400 rpm) speed operation. (Refer to paragraph 3-13c.)	The speeds are not within specified tolerances.
					X	e. Verify timer accuracy. (Refer to paragraph 3-13b.)	The timer intervals are not within specified tolerances.
					X	f. Check for excessive electrical arcing.	Electrical arcing causes unsafe operation or equipment wear.

3-10. Reporting deficiencies.

Operator/user personnel will report problems with the centrifuge discovered during their "-10 PMCS" that they are unable to correct. Refer to TB 38-750-2 and report the deficiency using the proper forms. Consult with your unit Medical Equipment Repairer if you need assistance.

Section V. OPERATIONAL TESTING

3-11. General.

This section contains procedures for operational testing of the centrifuge by both operator/user personnel and Medical Equipment Repairer personnel. Deficiencies identified by operator/user personnel should be reported to Medical Equipment Repairer personnel.

3-12. Operator/user tests (fig 3-1).

a. Timer test.

(1) Ensure that the timer pointer knob is at its "OFF" position.

(2) Connect the electrical power cable assembly into a 115-volt electrical receptacle.

(3) Verify that the rotor assembly is properly installed by opening the cover and then rotating the rotor assembly clockwise on the spindle. Close and latch the cover.

(4) Set the speed switch to its "LOW" position.

(5) Set the timer for approximately 1 minute by turning the timer pointer knob clockwise past the "1" marking and then counterclockwise back to the "1" position.

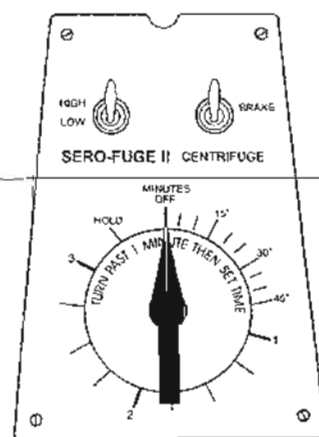


Figure 3-1. Nameplate assembly.

NOTE

The rotor assembly is now spinning.

(6) Observe that the timer pointer knob moves counterclockwise and turns off the centrifuge when the timer pointer knob is at the "OFF" position.

(7) Depress the "BRAKE" switch until the rotor assembly stops spinning and then release it.

(8) Notify your unit Medical Equipment Repairer if you observe any abnormal operation.

b. Speed test.

NOTE

Follow procedures (1) through (5) of the preceding timer test if this test is performed independently.

(1) Set the speed switch to its "HIGH" position by pushing the switch upward.

(2) Listen for the centrifuge motor to increase its speed.

(3) When the timer pointer knob rotates to its "OFF" position and turns off the centrifuge, depress the "BRAKE" switch downward until the rotor assembly stops spinning and then release it.

3-13. Medical Equipment Repairer tests.

a. Cover safety switch test (fig 3-2).

(1) Ensure that the timer pointer knob is at its "OFF" position.

(2) Connect the electrical power cable assembly into a 115-volt electrical receptacle.

(3) Verify that the rotor assembly is properly installed by opening the cover and then rotating the rotor assembly clockwise on the spindle.

(4) Close the cover but do not latch it.

(5) Set the speed switch to its "LOW" position.

(6) Set the timer for several seconds by turning its pointer knob clockwise and observing that the rotor assembly does not spin.

(7) Turn the timer pointer knob to its "OFF" position.

(8) Latch the cover.

(9) Perform the applicable troubleshooting procedures in accordance with this chapter, section VI, if the rotor assembly started to spin.

b. Timer test.

(1) Ensure that the timer pointer knob is at its "OFF" position.

(2) Connect the electrical power cable assembly into a 115-volt electrical receptacle.

(3) Pull the bottom of the cover latch outward and then open the centrifuge by lifting the cover.

(4) Verify that the rotor assembly is properly installed by opening the cover and then rotating the rotor assembly clockwise on the spindle.

(5) Close the cover and latch it.

(6) Set the speed switch to its "LOW" position.

(7) Set the timer pointer knob to its "HOLD" position.

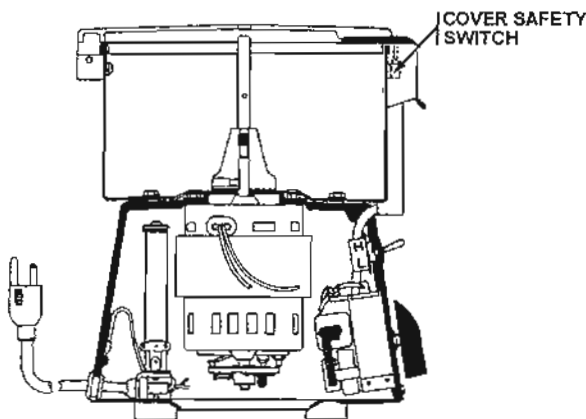


Figure 3-2. Cover safety switch.

(8) Prepare a stop watch or other timing device for 3 minutes.

(9) Rotate the timer pointer knob to its "3" minute position and observe its position at the expiration of 1-minute intervals.

(10) Replace the timer assembly if it is not accurate by following the repair procedures within this chapter, section VIII.

c. Speed test.

(1) Ensure that the timer pointer knob is at its "OFF" position.

(2) Connect the electrical power cable assembly into a 115-volt electrical receptacle.

(3) Pull the bottom of the cover latch outward and then open the centrifuge by lifting the cover.

(4) Verify that the rotor assembly is properly installed by opening the cover and then rotating the rotor assembly clockwise on the spindle.

(5) Close the cover and latch it.

(6) Set the speed switch to its "LOW" position.

(7) Set the timer pointer knob to its "HOLD" position.

(8) Measure the rotor assembly speed using a phototachometer.

(9) Observe the phototachometer reading and ensure the speed is 2400 ± 100 rpm.

(10) Set the speed switch to its "HIGH" position.

(11) Measure the rotor assembly speed using the phototachometer.

(12) Observe the phototachometer reading and ensure the speed is 3400 ± 100 rpm.

(13) Turn the timer pointer knob counterclockwise to its "OFF" position.

(14) Perform the applicable troubleshooting procedures in accordance with this chapter, section VI, if either speed is not within the specified ranges.

d. Brake test.

(1) Ensure that the timer pointer knob is at its "OFF" position.

(2) Connect the electrical power cable assembly into a 115-volt electrical receptacle.

(3) Pull the bottom of the cover latch outward and then open the centrifuge by lifting the cover.

(4) Verify that the rotor assembly is properly installed by opening the cover and then rotating the rotor assembly clockwise on the spindle.

(5) Close the cover and latch it.

(6) Set the speed switch to its "LOW" position.

(7) Set the timer to 1 second by turning the pointer knob clockwise past the "1" position and then counterclockwise to the "1" position.

(8) When the timer pointer knob moves to its "OFF" position, depress the "BRAKE" switch and hold it down until the rotor assembly stops.

~~(9) Perform the applicable troubleshooting procedures in accordance with this chapter, section VI, if the brake fails to stop the rotor assembly.~~

Section VI. TROUBLESHOOTING

3-14. General.

a. Troubleshooting information for centrifuge operator/user personnel and for Medical Equipment Repairer personnel is provided in this section. Corrective actions beyond the capability or authority of operator/user personnel will be indicated by the phrase "Notify your unit's Medical Equipment Repairer."

b. This manual cannot list all possible malfunctions. If a malfunction is either not listed or is not determined by routine diagnostic procedures, notify your appropriate maintenance support unit.

3-15. Operator/user troubleshooting.

Operator/user troubleshooting procedures are provided in table 3-3. Each symptom is followed by possible causes and corrective actions.

Table 3-3. Operator/user troubleshooting.

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE MAINTENANCE
1. CENTRIFUGE DOES NOT OPERATE.	Defective electrical power cable assembly. Notify your unit's Medical Equipment Repairer.	Defective cover latch assembly. Open and close the cover again and then try to operate the centrifuge. Notify your unit's Medical Equipment Repairer if the centrifuge still does not operate.
	Defective timer, speed switch, or motor. Notify your unit's Medical Equipment Repairer.	
2. ROTOR ASSEMBLY DOES NOT LOCK INTO PLACE.	Defective spindle. Notify your unit's Medical Equipment Repairer.	Broken rotor assembly. Replace rotor assembly.
3. CENTRIFUGE DOES NOT SPIN IN HIGH OR LOW SPEED.	Defective speed switch. Notify your unit's Medical Equipment Repairer.	
4. CENTRIFUGE SPINS WITH COVER OPEN.	Defective cover safety switch. Stop operation immediately and notify your unit's Medical Equipment Repairer.	
5. CENTRIFUGE DOES NOT BRAKE.	Defective brake switch. Notify your unit's Medical Equipment Repairer.	Defective brake circuit components. Notify your unit's Medical Equipment Repairer.
6. OPERATION IS NOISY.	Defective motor. Notify your unit's Medical Equipment Repairer.	

3-16. Medical Equipment Repairer troubleshooting.

Medical Equipment Repairer troubleshooting procedures are provided in table 3-4. Each symptom is followed by possible causes and corrective actions.

Table 3-4. Medical Equipment Repairer troubleshooting.

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE MAINTENANCE
1. CENTRIFUGE DOES NOT OPERATE.	Defective electrical power cable assembly. Repair or replace the cable assembly.	

Table 3-4. Medical Equipment Repairer troubleshooting - continued.

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE MAINTENANCE
	Defective 115-volt electrical receptacle.	Notify your unit's electrical power system personnel or correct the problem within the International Standards Organization (ISO) shelter.
	Defective cover latch assembly.	Troubleshoot the centrifuge and repair the electrical circuitry or replace the cover latch assembly.
	Defective timer.	Troubleshoot the centrifuge and repair the electrical circuitry or replace the timer.
	Defective speed switch.	Replace the switch.
	Defective brake switch.	Troubleshoot the centrifuge and repair the electrical circuitry or replace the brake switch or other defective circuit components.
	Defective motor.	Troubleshoot the motor and repair or replace as necessary.
2. CENTRIFUGE OPERATES WITH COVER OPEN.	Defective cover latch assembly.	Repair or replace assembly.
	Defective cover safety switch.	Replace switch.
3. CENTRIFUGE SPINS ONLY AT LOW SPEED.	Defective speed switch.	Replace switch.
4. CENTRIFUGE SPINS ONLY AT HIGH SPEED.	Defective speed switch.	Replace switch.
	Defective resistor (R2).	Replace resistor.
5. CENTRIFUGE SPINS AT HIGH SPEED IN LOW SPEED POSITION.	Defective speed switch.	Replace switch.
	Defective governor.	Adjust or replace governor.
	Defective governor circuit components.	Replace defective components.
6. ROTOR ASSEMBLY SPEEDS OUTSIDE SPECIFICATIONS.	Defective speed switch.	Replace switch.
	Defective governor.	Troubleshoot governor and repair or replace as necessary.
	Unserviceable brushes.	Replace brushes.
7. OPERATION IS NOISY.	Defective motor.	Repair or replace motor.

Section VII. CIRCUIT DESCRIPTIONS.

3-17. General.

a. The wiring diagram for the centrifuge is provided in figure 3-3 to assist you when troubleshooting. Isolate the problem to a functional segment of the circuitry.

b. Circuit descriptions are provided for the functional segments as well as individual component identification.

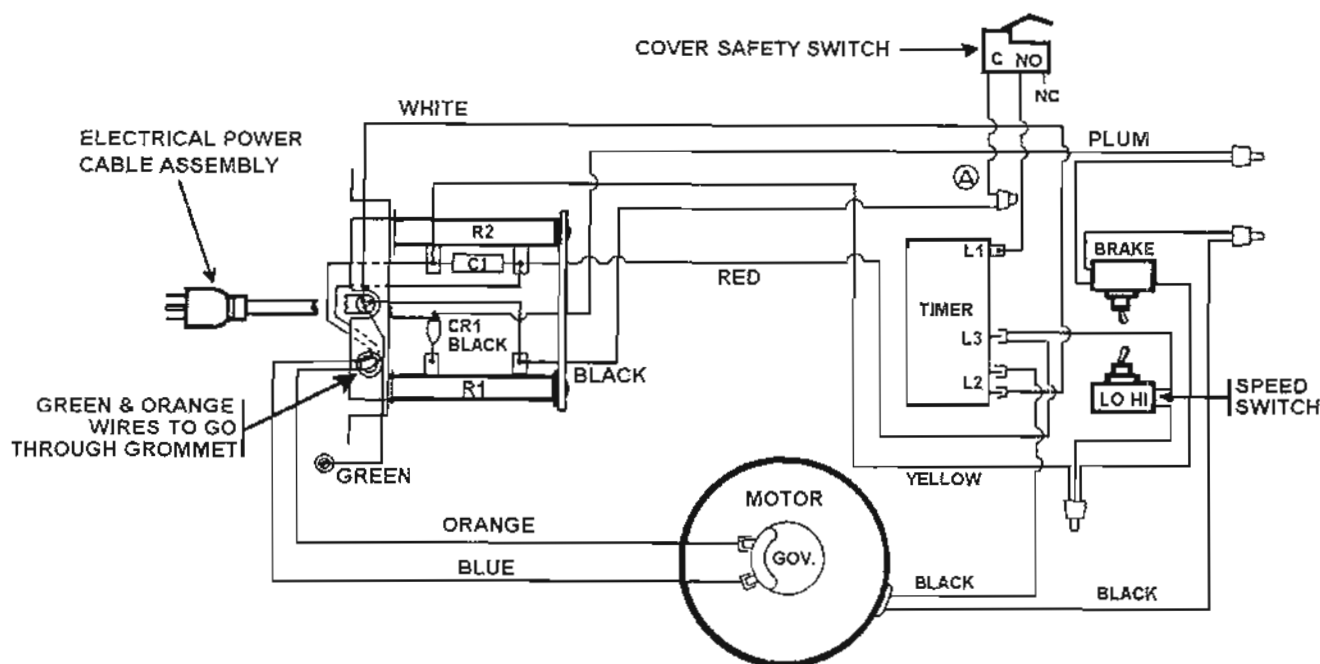


Figure 3-3. Wiring diagram.

3-18. Power circuit.

The neutral input (white) wire is connected to both the motor and the timer at terminal "L2." The hot input (black) wire is connected to terminal "L1," when the cover is closed, by the cover safety switch. Then, when the timer is rotated from the "OFF" position, the timer switch is turned on which provides electrical power to the timer motor across "L1" and "L2." The hot input wire is also switched to terminal "L3."

3-19. Motor circuit.

Current flows through resistor (R2), capacitor (C1), and the governor circuit when the speed switch is in the "LOW" (open) position. When the rotor speed is below 2400 ± 100 rpm, the governor switch points are closed allowing full line voltage through the governor switch to the motor. When the rotor speed increases over 2400 ± 100 rpm, the centrifugally operated governor switch points open, and resistor (R2) completes the circuit which causes the rotor speed to drop. This cycle is repeated very rapidly during operation which allows smooth speed regulation. Capacitor (C1) functions as an arc suppressor to protect the governor points. Full line voltage flows to the motor when the speed switch is in the high (closed) position because resistor (R2), capacitor (C1), and the governor are bypassed. When the brake

switch is depressed, a rectifier (CR1) and resistor (R1) are connected into the input hot wire to supply a half-wave braking current. This braking action occurs regardless of the timer switch or cover safety switch positions.

Section VIII. REPAIR PROCEDURES

3-20. General.

a. Procedures for disassembly, repair, or replacement of components, services, and reassembly are provided in this section of the manual.

b. Repair procedures are continuous from the first disassembly to the final reassembly step.

WARNING

Hazardous voltages are accessible inside the centrifuge when the base plate is removed for troubleshooting and/or repairs.

c. Test the centrifuge after each repair.

3-21. Governor brushes (fig 3-4).

a. Disassembly.

- (1) Turn the timer to its "OFF" position.
- (2) Disconnect the electrical power cable assembly from the electrical receptacle.
- (3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (4) Remove the rotor assembly by pulling it upward. Set it aside.

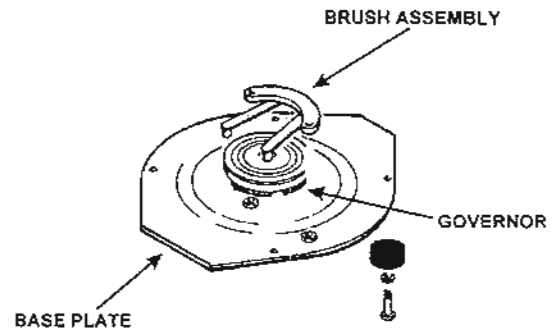


Figure 3-4. Governor brushes.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

- (5) Close and latch the cover.
- (6) Place a clean, soft cloth on your workbench and then turn the centrifuge over and set it on its cover.
- (7) Remove the four slotted screws fastening the four rubber feet and base plate. Set them all aside.

b. Maintenance services.

- (1) Locate the brush assembly.
- (2) Depress each brush holder with your finger and verify that each brush length is at least $\frac{1}{8}$ inch. If the length of the brushes is less than $\frac{1}{8}$ inch, replace the brush assembly as follows:
 - (a) Record the wire colors and electrical terminal connector locations on the brush assembly.
 - (b) Remove the two electrical terminal connectors from the brush assembly.
 - (c) Remove the two hex nuts fastening the brush assembly to the motor housing. Set them aside.
 - (d) Remove the brush assembly and set it aside.
 - (e) Acquire a replacement brush assembly.
 - (f) Position the replacement brush assembly into place and fasten it to the motor housing by reinstalling the two hex nuts.

(g) Reinstall the two electrical terminal connectors while following the previously recorded wire color and connector locations.

(h) Check for a $1\frac{1}{32}$ -inch clearance between the lower brush assembly plate and the governor slip rings (fig 3-5).

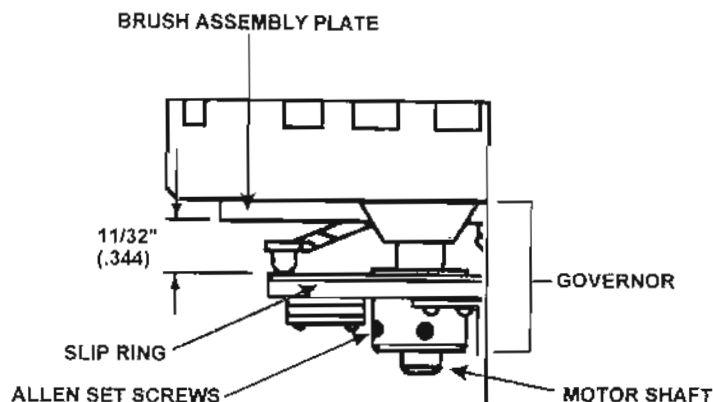


Figure 3-5. Governor brush assembly clearance.

NOTE

Adjust the clearance by loosening the Allen set screws, setting the clearance to $1\frac{1}{32}$ -inch, and then retightening the Allen set screws.

c. Reassembly.

- (1) Align the base plate and four rubber feet onto the base of the centrifuge.
- (2) Reinstall the four slotted screws and tighten them.
- (3) Turn the centrifuge back over to its operating position.
- (4) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (5) Reinstall the rotor assembly by pushing it down over the spindle and then rotating it clockwise until it locks.
- (6) Close and latch the cover.

3-22. Governor (fig 3-6).

a. Disassembly.

- (1) Turn the timer to its "OFF" position.
- (2) Disconnect the electrical power cable assembly from the electrical receptacle.
- (3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (4) Remove the rotor assembly by pulling it upward. Set it aside.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

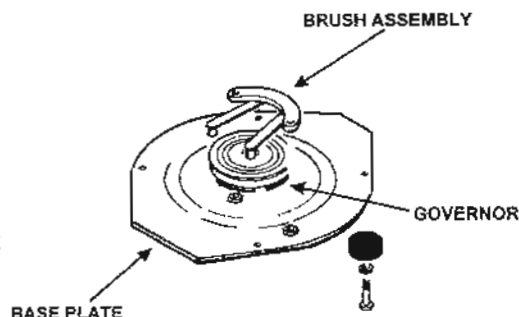


Figure 3-6. Governor.

- (5) Close and latch the cover.
- (6) Place a clean, soft cloth on your workbench and then turn the centrifuge over and set it on its cover.
- (7) Remove the four slotted screws fastening the four rubber feet and base plate. Set them aside.
- (8) Loosen the Allen set screws fastening the governor to the motor shaft (fig 3-7).

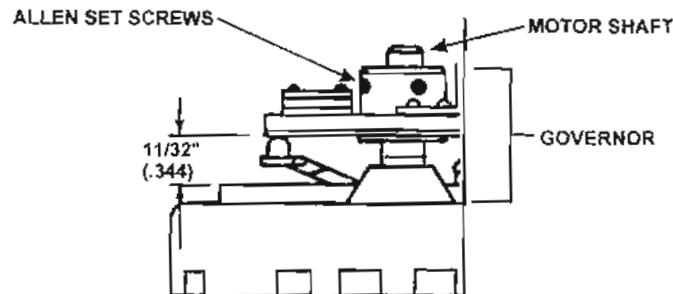


Figure 3-7. Governor removal.

- (9) Remove the governor by pulling it upward off the motor shaft. Discard it.
- (10) Record the wire colors and electrical terminal connector locations on the brush assembly.
- (11) Remove the two electrical terminal connectors from the brush assembly.
- (12) Remove the two hex nuts fastening the brush assembly to the motor housing. Set the hex nuts aside and discard the brush assembly.

NOTE

The brush assembly should always be replaced when the governor is replaced.

b. Maintenance services.

- (1) Acquire a replacement governor and a replacement brush assembly.
- (2) Clean the interior of the centrifuge, as required.

c. Reassembly.

- (1) Install the replacement brush assembly and fasten it to the motor housing by reinstalling the two hex nuts.
- (2) Reinstall the two electrical terminal connectors while following the previously recorded wire colors and connector locations.
- (3) Install the replacement governor onto the motor shaft and slightly tighten the Allen set screws.
- (4) Check for a 11/32-inch clearance between the lower brush assembly plate and the governor slip rings (fig 3-8).

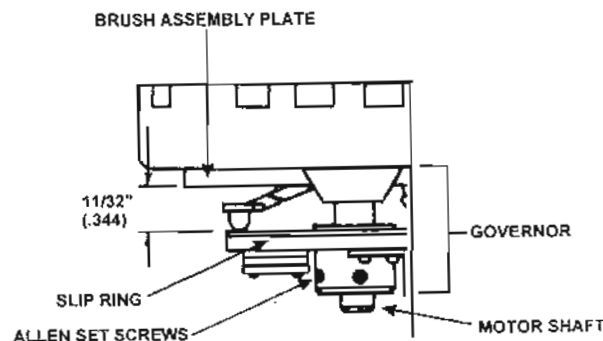


Figure 3-8. Governor brush assembly clearance.

NOTE

Adjust the clearance by loosening the Allen set screws fastening the governor to the motor shaft, setting the clearance to $1\frac{1}{32}$ inch, and then retightening the Allen set screws.

- (5) Align the base plate and four rubber feet onto the base of the centrifuge.
- (6) Reinstall the four slotted screws and tighten them.
- (7) Turn the centrifuge back over to its operating position.
- (8) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (9) Reinstall the rotor assembly by pushing it down over the spindle and then rotating it clockwise until it locks.
- (10) Close and latch the cover.

3-23. Motor (fig 3-9).

a. Disassembly.

- (1) Turn the timer to its "OFF" position.
- (2) Disconnect the electrical power cable assembly from the electrical receptacle.
- (3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (4) Remove the rotor assembly by pulling it upward. Set it aside.

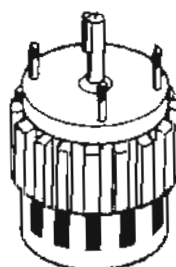


Figure 3-9. Motor.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

- (5) Close and latch the cover.
- (6) Place a clean, soft cloth on your workbench and then turn the centrifuge over and set it on its cover.
- (7) Remove the four slotted screws fastening the four rubber feet and base plate. Set them aside.
- (8) Remove the four slotted screws fastening the nameplate assembly. Set them aside.
- (9) Tilt the nameplate assembly for access to the timer and brake switch.
- (10) Cut the plastic electrical cable tie. Discard it.
- (11) Cut the crimped wire connector from the two black wires connecting the motor to the brake switch. ~~Discard the connector.~~
- (12) Disconnect the electrical terminal connector from the timer "L2" terminal that connects to the motor.
- (13) Position the nameplate assembly back into place and hold it in position by temporarily installing one or two of the slotted screws used to fasten the nameplate assembly to the base of the centrifuge.
- (14) Turn the centrifuge to its upright operating position.
- (15) Remove the six hex screws and special washers fastening the guard to the base of the centrifuge. Set them aside.
- (16) Remove the slotted screws installed in step (13) to temporarily fasten the nameplate assembly in place. Set them aside.

(17) Grasp the base in one hand and the guard in your other hand while simultaneously lifting upward on the guard to lift it off the centrifuge base assembly. Lay it down carefully.

NOTE

Do not remove the two wires going to the cover safety switch.

- (18) Loosen the two spindle set screws with an Allen wrench.
- (19) Remove the spindle from the motor shaft by pulling it upward. Set it aside.
- (20) Remove the rubber shield by lifting it off the centrifuge base assembly. Set it aside.
- (21) Remove the four rubber spacers from the motor mounting nuts. Set them aside.
- (22) Remove the four self-locking hex nuts from the motor mounting bolts. Set them aside.

NOTE

The motor will drop down to the work surface when the last self-locking hex nut is removed.

- (23) Tilt the centrifuge base assembly over and remove the motor. Discard the motor.

b. Maintenance services.

- (1) Clean the interior of the centrifuge base assembly, as required.
- (2) Acquire a replacement motor.
- (3) Inspect the four self-locking nuts, the four rubber spacers, the four special washers, and the rubber shield for serviceability. Acquire replacements as required.

c. Reassembly.

- (1) Tilt the centrifuge base assembly over and position the motor into place by pushing the four mounting bolts through the four holes in the base assembly. Hold it in place with your hand.
- (2) Reinstall the four self-locking hex nuts.
- (3) Reinstall the four rubber spacers onto the motor mounting bolts.
- (4) Reinstall the rubber shield.
- (5) Replace the spindle onto the motor shaft and fasten it by tightening the two set screws with an Allen wrench.

NOTE

The set screws must be aligned with the flat surface on the motor shaft.

- (6) Lift the guard up and over the spindle and then position it with the latch assembly facing forward. Then, align the mounting holes.
- (7) Reinstall a slotted screw into the nameplate assembly to temporarily hold it in place.
- (8) ~~Reinstall the six hex screws and special washers to refasten the guard to the base assembly.~~
- (9) Close the cover and latch it.
- (10) Turn the centrifuge over to rest on its cover.
- (11) Remove the slotted screw fastening the nameplate assembly temporarily into place.
- (12) Reconnect the electrical terminal connector to the timer "L2" terminal that also connects with the motor.
- (13) Strip 3/8-inch insulation from the two black wires connecting the motor to the brake switch.
- (14) Connect the two black wires using an electrical terminal connector.
- (15) Bundle the electrical wires together and refasten them with a plastic electrical cable tie.
- (16) Position the nameplate assembly into place and reinstall the four slotted screws.

(17) Install a new brush assembly into place and fasten it to the motor housing by reinstalling the two hex nuts.

(18) Reconnect the two electrical terminal connectors while following the previously recorded wire colors and connector locations.

(19) Reinstall the governor onto the motor shaft and slightly tighten the Allen set screws.

(20) Check for a $1\frac{1}{32}$ -inch clearance between the lower brush assembly plate and the governor slip rings (fig 3-10).

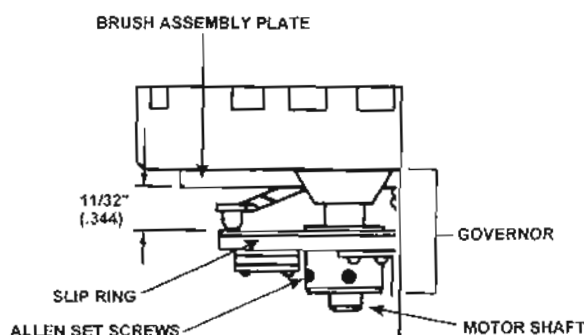


Figure 3-10. Governor brush assembly clearance.

NOTE

Adjust the clearance by loosening the Allen set screws fastening the governor to the motor shaft, setting the clearance to $1\frac{1}{32}$ -inch, and then retightening the Allen set screws.

(21) Align the base plate and four rubber feet onto the base of the centrifuge.

(22) Reinstall the four slotted screws and tighten them.

(23) Turn the centrifuge back over to its operating position.

(24) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.

(25) Reinstall the rotor assembly by inserting it down over the spindle and then rotating it clockwise until it locks.

(26) Close and latch the cover.

3-24. Electrical power cable assembly (fig 3-11).

a. Disassembly.

(1) Turn the timer to its "OFF" position.

(2) Disconnect the electrical power cable assembly from the electrical receptacle.

(3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.

(4) Remove the rotor assembly by pulling it upward. Set it aside.

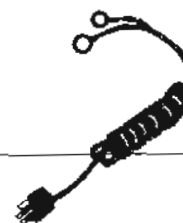


Figure 3-11. Electrical power cable assembly.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

(5) Close and latch the cover.

(6) Place a clean, soft cloth on your workbench and then turn the centrifuge over and set it on its cover.

- (7) Remove the four slotted screws fastening the four rubber feet and base plate. Set them aside.
- (8) Remove the four slotted screws fastening the nameplate assembly. Set them aside.
- (9) Pull the electrical terminal connector on the white wire from the timer "L2" terminal.
- (10) Record the wire colors and electrical terminal connector locations on the brush assembly.
- (11) Pull the two electrical terminal connectors from the brush assembly.
- (12) Remove the two slotted screws fastening the resistor mounting assembly to the base assembly. Set them aside.
- (13) Remove the slotted screw fastening the electrical ring connector of the green ground wire to the base assembly. Set the screw aside.
- (14) Pull upward on the resistor mounting assembly and remove it from the base assembly.
- (15) Remove the black wire from the electrical power cable assembly from the bottom electrical connector of resistor R1.
- (16) Remove the electrical power cable assembly from the base assembly.
- (17) Remove the rubber grommet and electrical cable strain relief bushing from the electrical power cable assembly. Retain the rubber grommet and strain relief bushing, if serviceable. Retain the electrical power cable assembly for preparation of the replacement electrical power cable assembly. Then discard it.

b. Maintenance services.

- (1) Acquire a replacement electrical power cable assembly.

NOTE

Acquire a replacement rubber grommet and/or a replacement strain relief bushing, as required.

- (2) Prepare the replacement electrical power cable assembly to match the original cable to include the following:

- (a) Remove the electrical power cable assembly external insulation.
- (b) Install an electrical terminal connector on the white wire.
- (c) Install an electrical ring terminal on the green wire.
- (d) Remove approximately 1/4-inch insulation from the black wire. Then tin the wire.

c. Reassembly.

- (1) Slip the rubber grommet onto the electrical power cable assembly.
- (2) Push and pull the black wire through the rubber gasket mounted on the resistor mounting bracket.

NOTE

Orange and blue wires are already within the rubber gasket.

-
- (3) Solder the black wire to the bottom terminal of resistor R1.
 - (4) Refasten the green ground wire to the base assembly with a slotted screw through the electrical ring connector.
 - (5) Drop the resistor mounting assembly back into the base assembly and position the wires into place.
 - (6) Connect the electrical terminal connector on the wire to the timer "L2" terminal.
 - (7) Reposition the nameplate assembly into place and refasten it with the four slotted screws.
 - (8) Reconnect the orange and blue wires to the brush assembly while following the previously recorded positions.
 - (9) Reinstall the two slotted screws to refasten the resistor mounting assembly.
 - (10) Reinstall the strain relief bushing and push it into its slot in the resistor mounting assembly.
 - (11) Adjust the position of the rubber grommet to fit into its mounting hole in the base assembly.

- (12) Align the base plate and four rubber feet onto the base of the centrifuge.
- (13) Replace the four slotted screws and tighten them.
- (14) Turn the centrifuge back over to this operating position.
- (15) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (16) Reinstall the rotor assembly by inserting it down over the spindle and then rotating it clockwise until it locks.
- (17) Close and latch the cover.

3-25. Speed switch (fig 3-12).

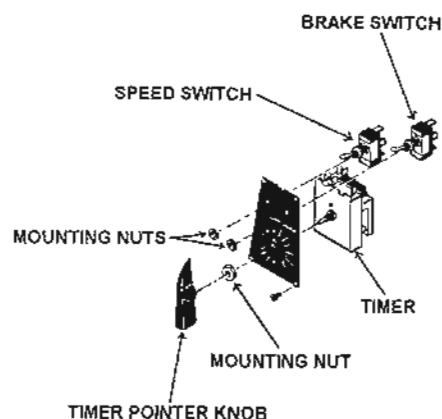


Figure 3-12. Speed switch.

a. Disassembly.

- (1) Turn the timer to its "OFF" position.
- (2) Disconnect the electrical power cable assembly from the electrical receptacle.
- (3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (4) Remove the rotor assembly by pulling it upward. Set it aside.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

- (5) Close and latch the cover.
- (6) Place a clean, soft cloth on your workbench and then turn the centrifuge over and set it on its cover.
- (7) Remove the four slotted screws fastening the four rubber feet and base plate. Set them aside.
- (8) Remove the four slotted screws fastening the nameplate assembly. Set them aside.
- (9) Pull the electrical terminal connector from the timer that connects a red wire and one of the black wires of the switch.
- (10) Snip the plastic electrical cable tie from the wiring bundle.
- (11) Locate the other black wire from the speed switch and cut off the crimped electrical cable connector.
- (12) Snip the electrical terminal connector that connects the black and red wires removed in step (9) above.
- (13) Remove the round speed switch mounting nut from the front of the nameplate assembly. Set them aside.

(14) Remove the speed switch from the nameplate assembly. Discard it.

b. Maintenance services.

(1) Acquire a replacement speed switch.

(2) Acquire replacement electrical terminal connectors.

c. Reassembly.

(1) Push the replacement speed switch through the back of the nameplate assembly and fasten it with a mounting nut.

(2) Strip approximately 1/4-inch of insulation from both speed switch wires.

(3) Strip approximately 1/4-inch of insulation from the red wire disconnected in the disassembly procedure.

(4) Install an electrical terminal connector to the red wire and one of the speed switch wires.

(5) Reconnect the electrical terminal connector to the timer.

(6) Strip approximately 1/4-inch of insulation from the black wire disconnected in the disassembly procedure.

(7) Install an electrical terminal connector to the two black wires.

(8) Install an electrical cable tie around the bundle of wires.

(9) Position the nameplate assembly into place and refasten it by reinstalling the four slotted screws.

(10) Align the base plate and four rubber feet onto the base of the centrifuge.

(11) Reinstall the four slotted screws and tighten them.

(12) Turn the centrifuge back over to its operating position.

(13) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.

(14) Reinstall the rotor assembly by inserting it down over the spindle and then rotating it clockwise until it locks.

(15) Close and latch the cover.

3-26. Brake switch (fig 3-13).

a. Disassembly.

(1) Turn the timer to its "OFF" position.

(2) Disconnect the electrical power cable assembly from the electrical receptacle.

(3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.

(4) Remove the rotor assembly by pulling it upward. Set it aside.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

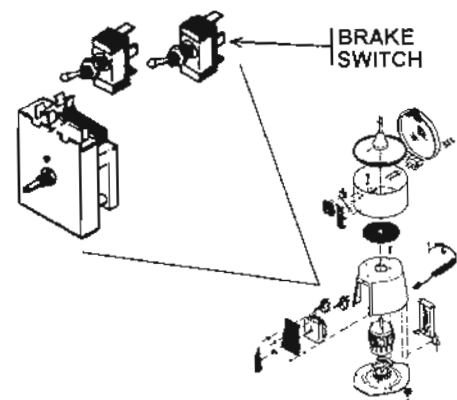


Figure 3-13. Brake switch.

(5) Close and latch the cover.

(6) Place a clean, soft cloth on your workbench and then turn the centrifuge over and set it on its cover.

(7) Remove the four slotted screws fastening the four rubber feet and base plate. Set them aside.

(8) Snip the plastic electrical cable tie from the wiring bundle.

(9) Remove the mounting nut from the brake switch. Set it aside.

(10) Push and pull the brake switch to remove it from the nameplate assembly.

b. Maintenance services.

- (1) Acquire a replacement speed switch.
- (2) Acquire three replacement electrical terminal connectors.

c. Reassembly.

- (1) Push the replacement brake switch through the back of the nameplate assembly and fasten it with a mounting nut.
- (2) Follow one of the wires from the defective brake switch to the crimped electrical terminal connector with another wire connected to it.
- (3) Snip the crimped electrical terminal connector from the two wires.
- (4) Snip the loose wire from the defective brake switch.
- (5) Locate the wire from the same position on the replacement brake switch.
- (6) Strip approximately 1/4-inch of insulation from this wire and the loose wire from step (3) above.
- (7) Reconnect the two wires using a new electrical terminal connector.
- (8) Repeat steps (2) through (7) for the remaining two brake switch wires.
- (9) Position the nameplate assembly into place and refasten it by reinstalling the four slotted screws.
- (10) Align the base plate and four rubber feet onto the base of the centrifuge.
- (11) Reinstall the four slotted screws and tighten them.
- (12) Turn the centrifuge back over to its operating position.
- (13) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (14) Reinstall the rotor assembly by inserting it down over the spindle and then rotating it clockwise until it locks.
- (15) Close and latch the cover.

3-27. Timer (fig 3-14).

a. Disassembly.

- (1) Turn the timer to its "OFF" position.
- (2) Disconnect the electrical power cable assembly from the electrical receptacle.
- (3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.
- (4) Remove the rotor assembly by pulling it upward. Set it aside.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

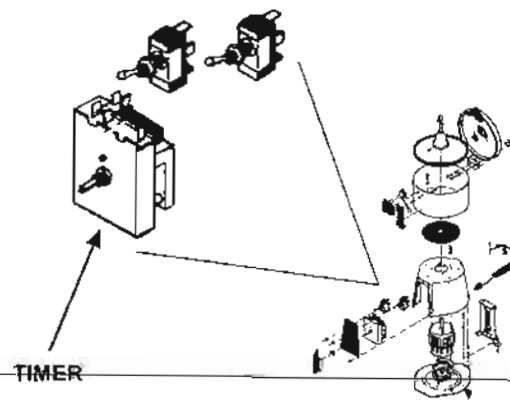


Figure 3-14. Timer.

- (5) Close and latch the cover.
- (6) Place a clean, soft cloth on your workbench and then turn the centrifuge over and set it on its cover.
- (7) Remove the four slotted screws fastening the four rubber feet and base plate. Set them aside.
- (8) Record the electrical wire colors and electrical terminal connector locations on the timer.
- (9) Remove the four electrical terminal connectors.
- (10) Loosen the set screws from the two sides of the timer pointer knob with an Allen wrench. Remove the pointer knob and set it aside.

(11) Remove the timer mounting nut. Set it aside.

(12) Remove the timer from the nameplate assembly. Discard it.

b. Maintenance service. Acquire a replacement timer.

c. Reassembly.

(1) Install the timer through the back of the nameplate assembly and fasten it by installing the timer mounting nut.

NOTE

Ensure that the timer is oriented with the electrical terminals toward the speed and brake switches.

(2) Reinstall the pointer knob onto the timer shaft by tightening the two Allen set screws.

NOTE

The pointer should be at the "OFF" position of the timer.

(3) Reconnect the four electrical terminal connectors while referring to the previously recorded wire colors and the position of the electrical terminal connectors on the timer.

(4) Position the nameplate assembly into place and refasten it by reinstalling the four slotted screws.

(5) Align the base plate and four rubber feet onto the base of the centrifuge.

(6) Reinstall the four slotted screws and tighten them.

(7) Turn the centrifuge back over to its operating position.

(8) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.

(9) Reinstall the rotor assembly by inserting it down over the spindle and then rotating it clockwise until it locks.

(10) Close and latch the cover.

3-28. Cover safety switch (fig 3-15).

a. Disassembly.

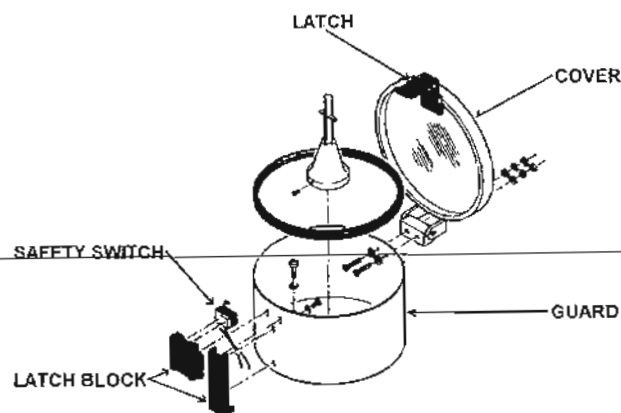


Figure 3-15. Cover safety switch.

(1) Turn the timer to its "OFF" position.

(2) Disconnect the electrical power cable assembly from the electrical receptacle.

(3) Open the cover by pulling the bottom of the latch outward and lifting the cover upward.

(4) Remove the rotor assembly by pulling it upward. Set it aside.

NOTE

Push downward on the spindle while simultaneously pulling upward on the rotor assembly if the rotor assembly is "stuck" on the spindle.

(5) Remove the four slotted screws and lock washers fastening the cover latch assembly to the centrifuge guard. Set the two pieces of the cover latch assembly aside for reuse.

(6) Remove the two black electrical wires from the switch terminals. Discard the switch.

CAUTION

Do not use excessive heat to remove the electrical wires from the switch terminals.

b. Maintenance services.

(1) Acquire a replacement switch.

(2) Acquire replacement insulation tubing.

c. Reassembly.

(1) Slip two 3/4-inch pieces of insulation over the two black electrical wires.

(2) Solder the electrical wires to the switch terminals.

(3) Reposition the lower section of the cover latch assembly onto the centrifuge guard and fasten it by reinstalling the two slotted screws.

(4) Reposition the upper section of the cover latch assembly onto the centrifuge guard and fasten it by reinstalling the two slotted screws.

(5) Reinstall the rotor assembly by inserting it down over the spindle and then rotating it clockwise until it locks.

(6) Close and latch the cover.

3-29. Other components.

Disassembly and reassembly of the centrifuge to repair or replace other components such as the cover hinge assembly or the cover latch do not require detailed instructions.

Section IX. VOLTAGE CONVERSION INSTRUCTIONS

3-30. General.

This section of the manual contains the procedures for changing the source of electrical power for operation of the centrifuge on 115 or 230 volts. Electrical connections for 230-volt use are illustrated in figure 3-16.

3-31. Procedures for 115-volt use.

a. Ensure that the timer pointer knob is at its "OFF" position.

b. Connect the electrical power cable assembly to a 115-volt electrical receptacle.

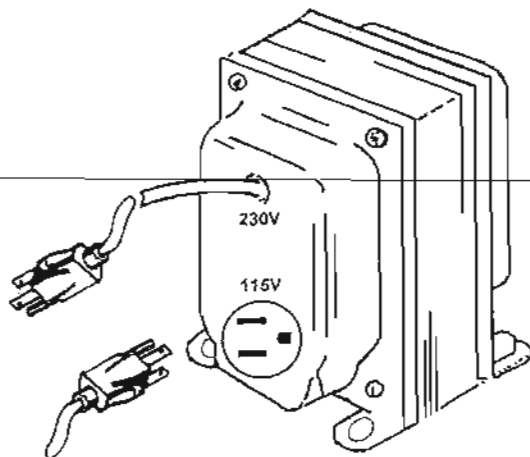


Figure 3-16. Electrical connections.

3-32. Conversion procedures (115 volts to 230 volts).

- a.* Ensure that the timer pointer knob is at its "OFF" position.
- b.* Remove the 115-volt electrical connector from the step-down transformer's electrical power cable assembly and replace it with a 230-volt electrical connector suitable for use in your location.
- c.* Connect the 115-volt electrical connector from the electrical power cable assembly of the centrifuge into the 115-volt electrical receptacle of the step-down transformer.
- d.* Connect the 230-volt electrical connector of the step-down transformer into an available 230-volt electrical receptacle.

Section X. STORING AND SHIPPING PROCEDURES

3-33. General.

This section contains the procedures for preparing the centrifuge for storing and shipping.

3-34. Preparation for storing.

- a.* Shut-down procedures for the centrifuge are as follows:
 - (1) Ensure that the timer pointer knob is at its "OFF" position.
 - (2) Disconnect the electrical power cable assembly from the electrical receptacle.
 - (3) Coil the centrifuge electrical power cable and tie it together.
 - (4) Coil the step-down transformer electrical power cable assembly and tie it together.
 - (5) Clean the centrifuge in accordance with the procedures in chapter 2, section V.
- b.* Inventory the components. Replace unserviceable or missing items.
- c.* Pack the centrifuge and components into its storage/shipping carton or another available container.

3-35. Preparation for shipping.

- a.* The centrifuge, packed in the original shipping carton, is suitable for shipping.
- b.* The centrifuge, packed in a military chest or other available container, will also be appropriately packed for shipping. Notify your unit transportation point for assistance, if necessary.

CHAPTER 4

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

Section I. GENERAL INFORMATION

4-1. Overview.

This chapter provides for maintenance that is beyond the capability, capacity, and authorization for unit level maintenance personnel. The procedures in this chapter will not be attempted at the unit level.

4-2. Tools and test equipment.

Common tools and test equipment required for support maintenance of the equipment are listed in appendix B, section III. Refer to your unit's MTOE or installation table of distribution and allowances (TDA) for authorized items.

4-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, sections II and III.

4-4. Expendable supplies.

Expendable and durable supplies and materials for support maintenance are listed in appendix D, section II.

4-5. Repair parts.

Repair parts required for support maintenance are listed in appendix E, section II.

4-6. Special tools.

Special tools required for support maintenance are listed in appendix E, section III.

Section II. MAINTENANCE PROCEDURES

4-7. General.

- a. There are no specific troubleshooting procedures for DS/GS levels of maintenance.
- b. Rebuild procedures for the centrifuge have not been developed.

APPENDIX A

REFERENCES

A-1. Army regulations.

AR 40-61	Medical Logistics Policies and Procedures
AR 710-2	Supply Policy Below the Wholesale Level
AR 725-50	Requisitioning, Receipt, and Issue System
AR 750-1	Army Materiel Maintenance Policy and Retail Maintenance Operations

A-2. Technical manual.

TM-DPSC-6500-RPL	Medical Materiel: Medical Repair Parts Reference List
------------------	---

A-3. Technical bulletins.

TB MED 7	Maintenance Expenditure Limits for Medical Materiel
TB 8-6500-MPL	Mandatory Parts List for Medical Equipment
TB 38-750-2	Maintenance Management Procedures for Medical Equipment
TB 740-10/DLAM 4155.5/AFR 67-43	Quality Control, Depot Storage Standards, Appendix M, Medical Supplies

A-4. Field manual.

FM 21-11	First Aid for Soldiers
----------	------------------------

A-5. Supply bulletin.

SB 8-75-()-series	Army Medical Department Supply Information
--------------------	--

A-6. Other publications.

(This publication may be obtained from Commander, U.S. Army Medical Materiel Agency, ATTN: MCMR-MMM, Frederick, MD 21702-5001.)

Operators Manual (1983), Clay Adams Division, Becton Dickinson and Company, Parsippany, NJ 07054.

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance levels.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions, explanatory notes, and/or illustrations required for a particular maintenance function.

B-2. Explanation of columns in section II.

a. Group Number, Column 1. The assembly group number (Group No.) column is a numerical group assigned to each assembly. The applicable assembly groups are listed in the maintenance allocation chart (MAC) in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.

b. Assembly Group, Column 2. This column contains a brief description of the components of each assembly group.

c. Maintenance Functions, Column 3. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance level authorized to perform these functions. The symbol designations for the various maintenance levels are as follows:

- C - Operator or crew
- O - Unit maintenance
- F - Direct support maintenance
- H - General support maintenance
- D - Depot maintenance

The maintenance functions are defined as follows:

A - Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards

B - Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C - Service. To clean, to preserve, to charge, and to add lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

D - Adjust. To rectify to the extent necessary to bring into proper operating range.

E - Align. To adjust specified variable elements of an item to bring it to optimum performance.

F - Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G - Install. To set for use in an operational environment such as tents or International Standards Organization shelters.

H - Replace. To replace unserviceable items with serviceable like items.

I - Repair. Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage to a specific failure. Repair may be accomplished at each level of maintenance.

J - Overhaul. Normally the highest degree of maintenance performed by the Army in order to minimize time work in process consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by a maintenance standard in technical publications for each item of equipment. Overhaul normally does not return an item to like new condition.

K - Rebuild. The highest degree of material maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance level.

d. *Tools and Equipment, Column 4.* This column is provided for referencing by code, the tools and test equipment (sec III) required to perform the maintenance functions.

e. *Remarks, Column 5.* This column is provided for referencing by code, the remarks (sec IV) pertinent to the maintenance functions.

B-3. Explanation of columns in section III.

a. *Reference Code, Column 1.* This column correlates to section II, column 4.

b. *Maintenance Level, Column 2.* This column identifies the maintenance levels using the tools and test equipment.

c. *Nomenclature, Column 3.* This column identifies the tools and test equipment.

d. *National Stock Number, Column 4.* This column provides the national stock number of the specific tools or test equipment.

B-4. Explanation of columns in section IV.

a. *Reference Code, Column 1.* This column correlates to section II, column 5.

b. *Remarks, Column 2.* This column provides supplemental information or explanatory notes pertinent to the maintenance function in section II.

Section II. MAINTENANCE ALLOCATION CHART FOR CENTRIFUGE

(1) GROUP NO.	(2) ASSEMBLY GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
00	Centrifuge	0 0.3	0 0.6	0 0.5					0 0.3	0 0.8	F 3.1	D 6.4	01,02,03, 04,05	A,B
01	Guard												01,02,03 04	A,B
	Latch	0 0.1							0 0.2	0 0.2				
	Latch Block	0 0.1							0 0.3	0 0.3				
	Cover Safety Switch		0 0.2						0 0.3					
	Rubber Channel	0 0.1							0 0.1					
	Cover	0 0.1							0 0.2					
02	Base Assembly												01,02,03 04,05	A,B
	Timer		0 0.2						0 0.4					
	Brake Switch		0 0.2						0 0.3					
	Speed Switch		0 0.3						0 0.5					
	Governor		0 0.3						0 0.5					
	Brush Assembly		0 0.3						0 0.4					

Section II. MAINTENANCE ALLOCATION CHART FOR CENTRIFUGE

[illegible]

Section III. TOOLS AND TEST EQUIPMENT FOR CENTRIFUGE

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER
01	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Repairmans	5180-00-611-7923
02	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Organizational	5180-00-611-7924
03	O,F,H,D	Multimeter, UN/USM 486 or Multimeter, AN/PSM 45A	6625-01-145-2430 6625-01-265-6000
04	O,F,H,D	Tester, Current Leakage, TS 2514/P	6625-01-142-8233
05	O,F,H,D	Tachometer, Noncontact, TS-4134(P)/G	6680-01-307-8190

Section IV. REMARKS FOR CENTRIFUGE

(1) REFERENCE CODE	(2) REMARKS
A B	Tools and test equipment are listed for each assembly group. Perform an annual electrical safety inspection and test. Perform the inspection and test after repair or replacement of electrical/electronic components.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. Scope.

This appendix lists components of end item and basic issue items for the equipment to help you inventory items required for safe and efficient operation.

C-2. General.

The Components of End Item and Basic Issue Items lists are divided into the following sections.

a. Section II. Components of End Item. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the equipment in operation, to operate it, and to perform emergency repairs. Basic issue items must be with the equipment during operation and whenever it is transferred between property accounts. This manual is your authority to request or requisition basic issue items, based on MTOE authorization of the end item.

C-3. Explanation of columns.

The following provides an explanation of columns found in both listings:

a. Item Number, Column 1. This column indicates the item number assigned to the item.

b. National Stock Number, Column 2. This column indicates the national stock number assigned to the item.

c. Description, Column 3. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the commercial and government entity (CAGE) code in parentheses followed by the part number.

d. Unit of Measure, Column 4. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation. These abbreviations are listed in the glossary.

e. Quantity, Column 5. This column indicates the quantity (QTY) of the item(s) provided with the equipment.

Section II. COMPONENTS OF END ITEM FOR CENTRIFUGE

[illegible]

**Section III. BASIC ISSUE ITEMS
FOR
CENTRIFUGE**

(1) ITEM NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
1		Operator's Manual (1A518) None	EA	2

APPENDIX D

EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. Scope.

This appendix lists expendable and durable supplies and materials that are required to maintain the equipment. This listing is authorization to requisition and retain the items if not otherwise authorized.

D-2. Explanation of columns.

- a. Item Number, Column 1.* The item number (Item No.) is sequentially assigned.
 - b. Level, Column 2.* This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.
 - c. National Stock Number, Column 3.* This column indicates the national stock number assigned to the item.
 - d. Description, Column 4.* This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.
 - e. Unit of Measure, Column 5.* This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by an alphabetical abbreviation. These abbreviations are listed in the glossary.
 - f. Quantity, Column 6.* This column indicates the quantity (QTY) of the item(s) provided with the equipment.
-

Section II. EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST FOR CENTRIFUGE

[illegible]

APPENDIX E

REPAIR PARTS AND SPECIAL TOOLS LIST

Section I. INTRODUCTION

E-1. Scope.

This manual lists spare and repair parts, special tools, special test equipment; and other special support equipment required for the performance of unit level, direct support, general support, and depot level maintenance. It authorizes the requisitioning and issue of spare and repair parts in consonance with the MAC (app B).

E-2. General.

The Repair Parts and Special Tools List is divided into the following sections:

- a. Repair Parts, Section II.* A list of repair parts authorized for the performance of maintenance in figure number and item number sequence.
- b. Special Tools, Test, and Support Equipment, Section III.* A list of special tools, test, and support equipment authorized for the performance of maintenance.

E-3. Explanation of columns in section II.

- a. Illustration, Column 1.*
 - (1) *Figure Number.* This column indicates the figure number (FIG NO.) of the illustration on which the item is shown.
 - (2) *Item Number.* This column indicates the item number (ITEM NO.) used to identify each item on the illustration.
- b. National Stock Number, Column 2.* This column indicates the national stock number assigned to the item.
- c. Description, Column 3.* This column indicates the federal item name of the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.
- d. Unit of Measure, Column 4.* This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.
- e. Quantity, Column 5.* This column indicates the quantity (QTY) of the item(s) to be used with or on the illustrated component, assembly, module, or end item.

E-4. Explanation of columns in section III.

- a. Item Number, Column 1.* This number is sequentially assigned.
- b. Level, Column 2.* This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.
- c. National Stock Number, Column 3.* This column indicates the national stock number assigned to the item.
- d. Description, Column 4.* This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.
- e. Unit of Measure, Column 5.* This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.
- f. Quantity, Column 6.* This column indicates the quantity (QTY) of the item(s) to be used with or on the illustrated component, assembly, module, or end item.

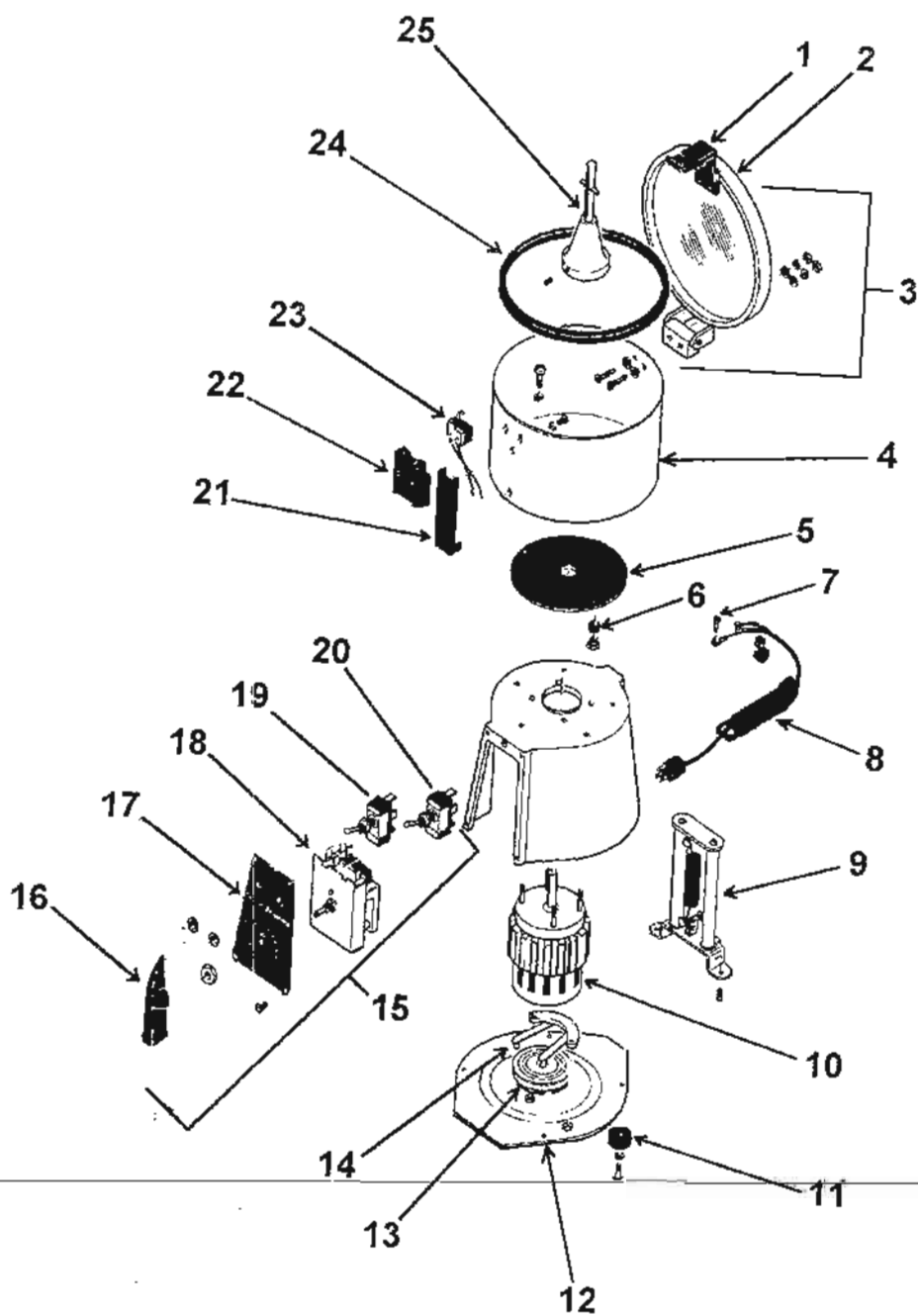


Figure E-1. Centrifuge components.

Section II. REPAIR PARTS LIST FOR CENTRIFUGE

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	1	5340-01-364-4111	Cover Assembly (Consists of Cover, Hinge, Latch, and Hardware) (65554) 0541-604-100	EA	1
E-1	2	5325-01-242-8387	Latch (Fastener Snapslide) (65554) 0591-604-101	EA	1
E-1	3	6640-00-445-1599	Cover (12717) 0541-604-001	EA	1
E-1	4		Guard (65554) 0541-605-101	EA	1
E-1	5	5330-01-371-9592	Seal, Nonmetallic (65554) 0541-614-100	EA	1
E-1	6		Spacer (65554) 0541-615-100	EA	4
E-1	7		Hardware (Consists of Screw, Binding Head, 6-32 by 1/4 in and Lockwasher, No. 5, Split) Bench stock	EA	1
E-1	8	6150-01-187-8449	Cable Assembly (Consists of Cable Assembly, Terminals, and Strain Relief Bushing) (65554) 0541-603-000	EA	1
E-1	9	5905-01-371-9587	Resistor Assembly (Consists of Mount, Resistor, and Capacitor) (65554) 0541-618-000	EA	1
E-1	10	6105-00-949-3693	Motor (65554) 0541-600-000	EA	1
E-1	11	6640-01-180-0469	Foot, Rubber with Hardware (OBZZ5) 0541-608-000	PG	1
E-1	12		Base Plate (65554) 0541-607-000	EA	1
E-1	13	6110-00-434-9109	Governor (12717) 0541-612-000	EA	1
E-1	14	5977-00-445-1598	Brush Assembly, Governor (12717) 0541-613-000	Ea	1

Section II. REPAIR PARTS LIST FOR CENTRIFUGE

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	15		Nameplate Assembly (65554) 0541-610-100 Item 15 consists of items 16-20	EA	1
E-1	16		Nameplate (65554) 0541-610-101	EA	1
E-1	17		Pointer Knob (65554) 0541-601-101	EA	1
E-1	18	6640-00-445-1625	Timer with Knob (12717) 0541-601-000	EA	1
E-1	19	5930-01-371-9650	Switch, High/Low (65554) 0541-611-000	EA	1
E-1	20	6640-01-372-0449	Switch, Brake (65554) 0541-602-000	EA	1
E-1	21		Cover Latch Assembly, Lower Section (Front Cover) (65554) 0541-617-100	EA	1
E-1	22	5325-01-243-1141	Cover Latch Assembly, Upper Section (Latch Block) (65554) 0541-616-100	EA	1
E-1	23	5930-01-190-8601	Switch, Safety (22353) 0541-602-100	EA	1
E-1	24	9390-00-809-0944	Channel, Nonmetallic (12717) 0521-608-001	EA	1
E-1	25	6640-01-181-3157	Spindle Assembly (65554) 0521-606-000	EA	1
E-1	*		Semiconductor Device, Diode (95335) D5210-545-03	EA	1
			*NOT ILLUSTRATED		

Section III. SPECIAL TOOLS, TEST, AND SUPPORT EQUIPMENT FOR CENTRIFUGE

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
			THERE ARE NO SPECIAL TOOLS, TEST, OR SUPPORT EQUIPMENT APPLICABLE FOR THIS END ITEM.		

GLOSSARY

AFR	Air Force regulation
amps (AMPS)	Amperes
AR	Army regulation
AR	As required
C	Capacitor
C	Common
C	Operator/crew
CAGE	Commercial and government entity
CAT	Catalog
cm	Centimeter
CN	Can
CR	Rectifier
CTA	Common table of allowances
CVC	Calibration/verification/certification
°C	Degrees Celsius
°F	Degrees Fahrenheit
D	Depot-level maintenance
DA	Department of the Army
DLAM	Defense Logistics Agency manual
DPSC	Defense Personnel Support Center
DS	Direct support
EA	Each
F	Direct support maintenance
FSCM	Federal supply code for manufacturers (Obsolete term, see CAGE)
fig (FIG)	Figure
g	Gravity
gal	Gallon
GOV	Governor
GS	General support
H	General support maintenance
Hz	Hertz (cycles per second)
in (IN)	Inch
ISO	International Standards Organization
kg	Kilogram
L	Line (terminal)
lbs	Pounds

MAC	Maintenance allocation chart
mm	Millimeter
MPL	Mandatory parts list
MTOE	Modified table of organization and equipment
NC	Normally closed
NO	Normally open
no (NO)	Number
NSN	National stock number
O	Unit maintenance
oz	Ounce
PCB	Printed circuit board
PMCS	Preventive maintenance checks and services
QC	Quality control
QTY	Quantity
R	Resistor
RO	Roll
RPL	Repair parts list
rpm	Revolutions per minute
SB	Supply bulletin
sec	Section
TB	Technical Bulletin
TDA	Table of distribution and allowances
TM	Technical Manual
TMDE	Test, measurement, and diagnostic equipment
TOE/MTOE	Table(s) of organization and equipment or modified table(s) of organization and equipment
V	Volts
VAC	Volts alternating current

INDEX

This index is organized alphabetically by topic and by subtopic. Topics and subtopics are identified by paragraph number.

Abbreviations, 1-2

Administrative storage, 1-5

Allen set screws, 3-21, 3-22, 3-23

Assembly, 2-2

Associated equipment, 2-8

Associated materiel, 2-9

Balance, 1-15

Basic issue items, 3-3, 4-3

Brake switch, 2-3, 3-16, 3-26

Brushes, governor, 3-21

Calibration/verification/certification (CVC) services, 3-1

Cell washing, 2-6

Characteristics, 1-11

Circuit

 Motor, 3-19

 Power, 3-18

Cleaning, 2-10, 2-11

Common names, 1-8

Components of end item, 3-3, 4-3

Conversion procedures, 3-30

Coombs test, 2-6

Cover safety switch, 2-3, 3-13, 3-15, 3-16, 3-28

Data plate, 1-13

Decals, 1-13

Deficiencies, reporting, 3-10

Destruction of Army materiel, 1-4

Dimensions, 1-13

Disinfecting, 2-11

Expendable supplies, 3-4, 4-4

Features, 1-11

Generator, 2-8

Governor brushes, 3-21

Governor, 3-16, 3-22

Hazard information, 1-13

Hex nuts, 3-21

Hex screws, 3-23

Latch 2-3

Lubrication, 3-8

Model differences, 1-14

Model number, 1-1

Motor circuit, 3-19

Motor, 3-23

Nomenclature cross-reference, 1-8

Official nomenclature, 1-8

Operational testing, 3-11

Operator maintenance, 3-1

Phototachometer, 3-13

Power cable assembly, 3-18

Power circuit, 3-18

Preparation for storage, 1-6

Preventive maintenance checks and services (PMCS), 1-5, 3-1, 3-9

Purpose of equipment, 1-1

Quality control, 1-7

Quality improvement report, 1-9

Records, 1-3

Reflector, 1-16

Repair parts, 3-5, 4-5

Rotor

Assembly, 1-12, 3-9, 3-15

Speed, 1-13

Rubber feet, 3-21, 3-22

Rubber spacers, 3-23

Safety, 1-15

Self-locking nuts, 3-23

Shipping, 3-35

Shut-down procedures, 2-7

Slip rings, 3-22

Specialist maintenance, 3-1

Special tools, 3-6, 4-6

Speed switch, 2-3, 3-12, 3-16, 3-25

Start-up procedures, 2-4, 2-5

Storage

Administrative, 1-5

Preparation, 1-6, 3-34

Switch

Cover safety, 2-3, 3-13, 3-15, 3-16, 3-28

Speed, 2-3, 3-12, 3-16, 3-25

Brake, 2-3, 3-6, 3-26

Temperature, 1-13

Test tubes, 1-12

Timer, 2-3, 3-12, 3-13, 3-27

Tools, 3-2, 4-2

Transformer, 1-11, 1-12

Troubleshooting, 3-14, 3-15, 3-16, 4-7

Unpacking the unit, 3-7

Unusual conditions, 2-12

Voltage, 1-13

Voltage conversion, 3-31, 3-32

Warranty, 1-10

Weight, 1-13

Wiring diagram, 3-17

By Order of the Secretary of the Army:

Official:



JOEL B. HUDSON

*Acting Administrative Assistant to the
Secretary of the Army*

GORDON R. SULLIVAN
*General, United States Army
Chief of Staff*

Distribution:

To be distributed in accordance with DA Form 12-34-E, block 4580, requirements for TM 8-6640-001-24&P.

*U.S. G.P.O.:1995-386-731:277

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

THEN... JOT DOWN THE
DOPE ABOUT IT ON THIS
FORM. CAREFULLY TEAR IT
OUT. FOLD IT AND DROP IT
IN THE MAIL!

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
Cdr, USABDD
Maintenance Shop
Frederick, MD 21702

DATE SENT

PUBLICATION NUMBER
TM 8-6640-001-24&P

PUBLICATION DATE
6 FEB 88

PUBLICATION TITLE
Centrifuge, Laboratory Model
SERO-FUGE II

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA- GRAPH	FIGURE NO	TABLE NO
2-7	2-5		
E-11		E-4	

IN THIS SPACE TELL WHAT IS WRONG
AND WHAT SHOULD BE DONE ABOUT IT:

Change electrical cable to electrical assembly.

REASON: Corrects nomenclature.

Reverse call-out numbers 4 and 8.

REASON: Correctly identifies part.

CUT ALONG PERFORATED LINE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, Maintenance Supervisor
DSN 343-XXXX

SIGN HERE

John Doe

DA FORM 2028-2
1 JUL 79

PREVIOUS EDITIONS
ARE OBSOLETE.

U.S. Government Printing Office: 1986-491-003/50523

P.S. - IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR
RECOMMENDATION MAKE A CARBON COPY OF THIS
AND GIVE IT TO YOUR HEADQUARTERS

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN, JOT DOWN THE
DOPE ABOUT IT ON THIS
FORM. CAREFULLY TEAR IT
OUT, FOLD IT AND DROP IT
IN THE MAIL!

SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

TM 8-6640-001-24&P

PUBLICATION DATE

PUBLICATION TITLE

Centrifuge, Laboratory Model
SERO-FUGE II

BE EXACT PIN-POINT WHERE IT IS

PAGE
NO

PARA-
GRAPH

FIGURE
NO

TABLE
NO

IN THIS SPACE TELL WHAT IS WRONG
AND WHAT SHOULD BE DONE ABOUT IT:

CUT ALONG PERFORATED LINE

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA FORM 2028-2
1 JUL 79

PREVIOUS EDITIONS
ARE OBSOLETE.

U.S. Government Printing Office: 1986-491-003/50523

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR
RECOMMENDATION MAKE A CARBON COPY OF THIS
AND GIVE IT TO YOUR HEADQUARTERS

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander
U.S. Army Medical Materiel Agency
ATTN: MCMR-MMM
Frederick, MD 21702-5001

CUT ALONG PERFORATED LINE

METRIC SYSTEM CONVERSIONS

<i>CHANGE</i>	<i>TO</i>	<i>MULTIPLY</i>	<i>CHANGE</i>	<i>TO</i>	<i>MULTIPLY</i>
inches	centimeters	2.540	centimeters	inches	.394
feet	meters	.305	meters	feet	3.280
yards	meters	.914	meters	yards	1.094
sq inches	sq centimeters	6.451	sq centimeters	sq inches	.155
sq feet	sq meters	.093	sq meters	sq feet	10.764
cubic feet	cubic meters	.028	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	milliliters	fluid ounces	.034
pints	liters	.473	liters	pints	2.113
quarts	liters	.946	liters	quarts	1.057
gallons	liters	3.785	liters	gallons	.264
ounces	grams	28.349	grams	ounces	.035
pounds	kilograms	.454	kilograms	pounds	2.205

TEMPERATURE CONVERSION

Degrees Fahrenheit to Degrees Celsius: $(^{\circ}\text{F} - 32) \times .5555 = ^{\circ}\text{C}$

Degrees Celsius to Degrees Fahrenheit: $(^{\circ}\text{C} \times 1.8) + 32 = ^{\circ}\text{F}$

WEIGHTS

1 gram = 10 decigrams = .035 ounce
 1 dekagram = 10 grams = .35 ounce
 1 hectogram = 10 dekagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds

CUBIC MEASURE

1 cu centimeter = 1000 cu millimeters = .06 cu inch
 1 cu decimeter = 1000 cu centimeters = 61.02 cu inches
 1 cu meter = 1000 cu decimeters = 35.31 cu feet

LINEAR MEASURE

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches

LIQUID MEASURE

1 centiliter = 10 milliliters = .34 fluid ounce
 1 deciliter = 10 centiliters = 3.38 fluid ounces
 1 liter = 10 deciliters = 33.81 fluid ounces